REMARKS

1. Information Disclosure Statement:

It appears from the Examiner's comments that form PTO-1449 is still missing from the file. Enclosed is a copy of form PTO- 1449 originally filed on October 24, 2003.

An original Information Disclosure Statement along with a properly completed form PTO-1449 was mailed via 1st Class Mail on October 24, 2003. The form PTO -1449 included (1) a list of all patents, publications, applications, or other information submitted for consideration by the Office; (2) U.S. patents and U.S. patent application publications listed in a section separately from citations of other documents; (3) the application number of the application in which the information disclosure statement is being submitted on each page on the list: (4) a column that provides a bank space next to each document to be considered, for the Examiner's initial; and (5) a heading that clearly indicates that the list is an information disclosure statement. Accompanying the Information Disclosure Statement was a Certificate of Mail and return postal card. The Applicant submits that if form PTO-1449 was missing from the file, its omission was caused by the Office and not by the Applicant. Therefore, a formal request is made that the information in the Information Disclosure Statement be fully considered.

In the Office Action mailed on 2/21/07, the Examiner maintained the rejection of Claims 1-17 and 20 under 35 U.S.C. 103(a) as being unpatentable over Otten et al. (U.S. Patent No. 6,821,211) in view of Ogawa et al. (U.S. Patent No. 4,451,043).

In response, Claim 1 has been amended to recite that the array of infrared sensors and the ultrasonic sensors are controlled so that when the golf club head moves across the hitting area, the array of infrared sensors located in front of the center axis sequentially activates the

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ultrasonic sensor in front of the center axis, and the array of infrared sensors and the ultrasonic sensor located on the opposite side of the center axis. In addition, Claim 1 has been amended to more clearly recite that the software program uses the data from the array of infrared sensors located in front of the center axis to determine the club speed and face angle, and uses the combined data from the two ultrasonic sensors to determine the swing path angle. All of the above limitations were originally recited in Claims 2, 4, and 5 which are now cancelled.

Also, Claim 15 has been amended to more clearly recite that the ultrasonic sensors are sequentially activated to produce ultrasonic signals when a golf club moves over the array of infrared sensors located in front of the center axis. No new matter is being introduced by these changes.

Also, Claims 6 and 15 have been amended to further describe the infrared sensors as 'pulsing' which finds support on page 8, lines 12-17. The advantage of using 'pulsing' infrared sensors is discussed further below.

In order to reach the finding that the invention recited in Claims 1 and 15, the Examiner simplified the teachings of Otten as disclosing a golf analyzing system that used various arrays of infrared sensors and that the reflective tape is not necessary. The Examiner assumed that the reflective tape disclosed in Otten is optional and only used to filter artifacts and shadows when direct light is present.

It is important that the Examiner understand how Otten's system operates so that Applicant's system may be better understood why it is a substantial improvement. In Otten two arrays of IR sensors and two ultrasonic sensors located on opposite sides of the ball. They are not activated in the same manner nor is data from them collected and used by the

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software program to produce the trajectory information.

A key aspect of Otten's system is that the special adhesive tape must be applied to the bottom surface of the golf club. Contrary to the Examiner's understanding, the reflective tape is not optional and only used to filter for artifacts and shadows. The purpose of the reflective tape is to reflect a narrow beam of infrared light transmitted onto the underside of the golf club onto detector elements associated with the sensors 12(a)-(d), (see Col. 3, lines 41-49). "The light striking the detectors is modulated by the passage of the reflective tape 19 as the club 16 travels along the swing path 18." (See Col. 3, lines 55-57). <u>Otten's</u> system will not operate with out reflective tape.

On Col. 5, line 65 thru Col. 6, line 22, Otten discusses in detail how the system uses the reflective tape to produce signals:

"As illustrated in FIG. 4, the computer device 14 is programmed to derive information of value from digitized signals fed from the controller 13. Those skilled in computer programming will be able to create a program in a suitable language to enable the data manipulation represented in the accompanying figures. For the following discussion, the term "sensor device" is intended to encompass the sensors 12a-d and the photo-detectors 24. First, data files are fed from the controller 13 to the computer 14 via a signal connector cable 25 that may be a parallel connector or preferably a serial connector of conventional design, such as a universal serial bus line, other serial interfaces, or wireless connector. The controller 13 monitors the sensor devices for change in state events and creates data files containing a sequence of events with their associated timestamps. *As used herein, a "change in state event" occurs whenever the leading or trailing edge of the reflective tape 19 passes over a sensor device.* Each file includes at least a particular sensor device identifier, a status field,

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and a time-of-actuation field. The sensor device identifier may be any sort of identifier recognizable by the program. The status field may be an ON/OFF indication, e.g., simply a "1" or a "0" representing whether the particular sensor device was actuated during a swing event. The time field is filled with the particular time of actuation as compared to actuation of the other sensor devices (see Col. 5, line 65 thru Col. 6, line 22). (Italic added)

In Otten, the second and third sensors 12b and 12c produce a continuous light beam. The output from the second and third sensors 12b and 12c are used to determine the path angle, club-head speed, club head angle and the club head lateral alignment. The second and fourth sensors 12b and 12d are used to determine the club head loft angle (see Col. 6, lines 50-65). In Otten, only reflective tape of a known width is attached to the bottom of the club head. The leading edge and trailing edge of the reflective tape is used to determine whether a signal detected is caused by a club head moving within a predicted speed range. If the timing of signals of the leading and trailing edges are too close or too far apart, Otten's system assumes that a club head is not swung over the device. The bottom line is that Otten's system must be used with reflective tape. Applicant's system does not require reflective tape because it uses different sensor that are coupled together in a unique manner.

In both previous Office Actions, the Examiner stated that IR sensors and ultrasonic sensors are well known to be interchangeable. The Examiner cited the following statement in Ogawa as support for this statement:

"Although the above embodiment refers to three magnetic sensors, the number is not so limited. Also, any detecting means, such as a photo-sensor, a Hall effect element, ultrasonic detector means, etc. capable of detecting a golf club head near an impact point may be used".

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The Applicant respectfully disagrees.

It is first pointed out that the above statement recited in Ogawa is merely the inventor's attempt to broaden the scope of the claims so that the system is not limited to magnetic sensors. It does not mean nor suggest that the IR sensors and ultrasonic sensors are widely interchangeable as suggested by the Examiner.

In every application, the decision to use either IR or ultrasonic sensors depends on the object being detected, the nature of the movement, and what movement data is being calculated. Because IR sensors use light energy (2.99 x 10^8 m/sec) and the ultrasonic sensors use sonic energy (344 m/sec), they are not interchangeable when transmitting signals that reflect off moving objects where the speed of the signals are critical for accurate measures. Therefore, the Examiner's statement that IR sensors and ultrasonic sensors are interchangeable is not accurate.

As noted above, Claims 6 and 15 both recite each infrared sensor made up of pulsing infrared emitter and an infrared photodiode detector. By using 'pulsing' infrared energy, artifacts and false signals are eliminated. More specifically, each IR sensor includes an IR LED (light emitting diode) that produces a narrow cone of high power light that is strobed (pulsed on and off) vertically at a set frequency generated by the micro-controller. Each IR sensor also includes an IR photo detector (adjacent to each IR LED) placed under an IR filter (at the top of the nylon bushing holding both IR sensors in an injected molded part) the prevents a broad spectrum of ambient light from passing through the filter which limits transmission of a specific frequency of light (about 880 nm) (recited in Claim 8.) Under the filter, a specially designed lens has been placed to focus reflected IR light passing through the filter onto the active area of the photodiode, in effect, magnifying the strength of the IR

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energy that does make its way through the filter and lens (recited in Claim 9). An AC (alternating current) coupled amplifier is connected to each photodiode (to "magnify" and convert the small current produced when the photodiode detects IR energy to voltage). The amplifier is electrically designed to only respond to (detect) pulsing reflected IR energy of a certain frequency, which is generated by the micro-controller.

It should also be pointed out that both Otten and Ogawa teach the use of a clear plastic cover over the IR sensors and magnetic sensors, respectively, to prevent dirt, grass and other foreign material from contacting the sensors and other electronic components. Because a plastic cover blocks sonic energy, ultrasonic sensors can not be used in place of IR sensors.

Even if a plastic cover was not used, ultrasonic sensors cannot be used in place of IR sensors in either Otten's or Ogawa's application because the club head will pass too close to the sensor for detection. A single ultrasonic transducer must be operated in "pulse-echo" mode to detect a target. A minimum separation of more than 5 inches between the sensor and the target, such as a club head, is required to allow the transducer to stop "ringing" after the sonic package is transmitted (when detection can begin) and to account for round-trip travel of sonic energy at a typical speed of sound (SoS), which is about 13,500 inches per second in air. Minimum time to detect a target at minimum range in "pulse-echo" mode is about 750 uSec, which equates to roundtrip travel of sonic energy (distance = SoS x time) of about 10.125 inches. The minimum sensor-target separation, therefore, is 10.125/2 = 5.06 inches to use an ultrasonic sensor in pulse-echo mode.

With Applicant' device, two ultrasonic sensors are aligned on the ultrasonic sensor base 6 inches apart and approximately 6 inches away from the club head that will pass in front of each of the sensors. During use, the ultrasonic sensor base is rotated so that it is

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perpendicularly aligned with the infrared sensor base. The two ultrasonic sensors precisely measure the distance between the sensor and the club head as the club head passes immediately in front of each of the ultrasonic sensor. By comparing the two distances measured by the two ultrasonic sensors, the swing path angle is calculated. In order to accurately calculate the swing path angle, the distance between the ultrasonic sensor and the club head is measured to less than 1/10 of an inch. A difference of about 1/8" between the distances that the clubhead passes in front of each of the two ultrasonic sensors calculates to a swing path angle of 1 degree. This method of measuring swing path angle is different and far more accurate than the measurement method disclosed in <u>Otten</u>.

In <u>Otten</u>, the swing path angle is determined by IR sensors located in two arrays 12b and 12c located on opposite sides of the ball. Figs 1 and 2 show eleven IR sensors evenly spaced apart in each array. It can be assumed that the IR sensors are spaced apart more than 0.25". Also, it can be assumed that the arrays 12b and 12c spaced apart 4 inches or more. As a result, <u>Otten</u> cannot calculate swing path angle more accurately than approximately 3.5 degrees. If the sensors in each array are separated by greater distances, or if the distances between the two arrays are reduced, then <u>Otten's</u> device is even less accurate in measuring swing path angle.

Applicant's system specifically designed to be much <u>more</u> accurate than currently available systems. In order to meet this object, the system must use two arrays of IR sensors and two ultrasonic sensors located on opposite sides of the center axis that are sequentially activated and a software program that uses the data from the IR sensors and ultrasonic sensors to produce trajectory information.

For all of these reasons, the Examiner's rejection of Claims 1-20 is improper and

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should be withdrawn. Notice of Allowance is warranted.

Respectfully submitted,

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